CA2 ALEV 4
1972P61
c.1

CA2 ALEV 14 1972P04
Prospectus For Public Hearings: Environmental Effects of the Operation of 1
3 3398 00135 1559

c. 1
MAR 13 1973

A PROSPECTUS FOR PUBLIC HEARINGS

ENVIRONMENTAL EFFECTS OF THE OPERATION OF

# SULPHUR EXTRACTION GAS PLANTS

| | | |
|---|---|---|
| PINCHER CREEK | – | OCTOBER 2, 1972 |
| RED DEER | – | OCTOBER 5, 1972 |
| WHITECOURT | – | OCTOBER 11, 1972 |
| CALGARY | – | OCTOBER 16, 1972 |
| EDMONTON | – | OCTOBER 19, 1972 |

LIBRARY
VAULT 19

Alberta

ENVIRONMENT CONSERVATION AUTHORITY

JUNE, 1972

Digitized by the Internet Archive
in 2024 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

ENVIRONMENT CONSERVATION AUTHORITY
PROSPECTUS ON

# THE ENVIRONMENTAL EFFECTS OF THE OPERATION OF SULPHUR EXTRACTION GAS PLANTS IN ALBERTA

## INTRODUCTION

Alberta possesses reserves of energy fuels in more than one form. It has the good fortune that its coals, whether in the mountains or in the prairies, are relatively low in sulphur content.

This is an important advantage to the province in marketing both its coking and thermal coals, for in each of these applications sulphur would be a costly impurity. In addition the environmental effects of sulphur associated with coal, such as the acid effluents so well known in eastern coalfields, are not present here.

By contrast, however, a considerable proportion of the deposits of natural gas in the province do contain sulphur, sometimes in high percentages. The sulphurous compounds in natural gas are costly impurities and must be removed before the natural gas can be marketed. They also can present serious environmental hazards by nature of their toxicity and because of the unpleasant odors associated with them.

The Petroleum Gas Industry in Alberta has had many years of experience in the handling of sour gasses. During this time it has achieved significant improvements in gas processing technology and in handling the problems that sulfurous gasses have presented in the preparation of its products for the market.

During the same period the government introduced regulations which have also changed over the years and has developed and adopted methods for monitoring the compliance of the operating plants with these regulations.

The sour gas fields and the sulphur extraction plants are located in many areas of the province and large numbers of people have been exposed for many years to the operations of these plants. A number of claims and complaints concerning human and animal health, or damage and destruction

to crops and property have been made by persons living in the vicinity of operating gas plants, it has not always been possible to clearly establish the cause/effect relationships in cases like these.

The Environment Conservation Authority has now been requested by the Honourable W. J. Yurko, Minister of the Environment, to hold public hearings on the environmental effects of the operation of sulphur extraction gas plants in Alberta. The hearings are to take place during October, 1972, in Pincher Creek, Red Deer, Whitecourt, Calgary and Edmonton. The Authority will then submit to the government recommendations based on the information presented at the hearings.

## SULPHUR EXTRACTION IN ALBERTA

Several natural gas fields in Alberta have been found to contain sulphur in substantial quantities, the highest being in one field where the content of sulphur in the form of hydrogen sulphide accounts for 90% of the total volume of the gas. The maximum concentration of hydrogen sulphide in natural gas which is processed at present, however, is 50%. If a natural gas must be processed to remove hydrogen sulphide before it can be marketed, it is known as a "sour" or "acid" gas, whereas if the concentration of hydrogen sulphide in the gas as it comes from the well is low enough to require no special processing, it is called a "sweet" or "sales" gas.

In the early 1950's natural gas came into considerable demand as a source of energy and with improved technology it became economic to build processing plants to produce "sales" gas from sour gas fields. The hydrogen sulphide that was removed in the sweetening process was converted into elemental sulphur, itself a marketable commodity, and Alberta soon became a large producer of sulphur. By 1971, there were forty-two sulphur extraction plants in operation in Alberta and they were producing a total of 4.5 million long tons of elemental sulphur per annum.

The supply of sulphur however, has in the past several years exceeded the demand, due mainly to the huge quantities produced in Alberta, and as a result the price of sulphur has fallen from a high of $35.53 per ton in 1968 to the present level of about $7.50 per ton f.o.b. Alberta.

The excess sulphur which cannot be sold must be stored and by the end of 1971 the total stockpile in Alberta had grown to 5.3 million tons. It is estimated that the remaining established reserves of sour natural gas in Alberta contain about 180 million long tons of sulphur and that most of this will be recovered within the next twenty to thirty years. The supply of sulphur can therefore be expected to continue to increase and unless new markets are found for elemental sulphur, the Alberta stockpile will also continue to grow.

## HISTORY OF SULPHUR RELATED EMISSIONS

In the early days of the natural gas industry the comparatively small quantities of hydrogen sulphide which had to be removed from sour gases were burned in special furnaces to convert the hydrogen sulfide into sulphur dioxide. Sulphur dioxide is a less toxic and less odorous gas at low concentrations and all that was produced was allowed to go into the air through tall stacks. As the industry developed and sour gases containing greater quantitites of hydrogen sulphide came to be processed, this method of handling the hydrogen sulphide was found to be no longer adequate because of the excessive quantities of sulphur dioxide that would have to be liberated into the atmosphere. The industry also realized at this time, that a marketable product could be obtained if the hydrogen sulphide was not vented as sulphur dioxide but was instead converted into elemental sulphur. In 1951 the first sulphur extraction gas processing plant in Alberta was built at Jumping Pound. Although the gaseous compounds released to the atmosphere from a gas processing plant, which are of major concern, are hydrogen sulphide and sulphur dioxide, there may also be other compounds of sulphur or other toxic chemicals released in small quantities. The efforts of both government and industry are now being directed towards the identification and measurement of these emissions as well, and standards are being developed for their control.

Today, whenever hydrogen sulphide is recovered in any appreciable quantity the sulphur is extracted in elemental form. Since the percentage of hydrogen sulphide in the sour gas varies from field to field, however, not all processing plants in Alberta have sulphur extraction facilities. Out of a total of sixty-seven plants processing sour gas in 1971, forty-two

were equipped to recover solid sulphur, while the remainder vented all sulphur as sulphur dioxide. Even in those plants which recover solid sulphur the sulphur extraction operation is not 100% efficient and that part of the hydrogen sulphide which is not converted into elemental sulphur by the process still has to be burned and vented into the air as sulphur dioxide. As a result, the total emission of sulphur as sulphur dioxide from all sour gas processing plants in the province in 1971 was over 450 long tons per day.

In the interest of environmental protection as well as the conservation of the sulphur resource the gas industry will be required within the next two years to recover a higher percentage of sulphur from the hydrogen sulphide in its gas. While this measure will reduce the total sulphur dioxide emissions for a period of time, the possibility still exists that the total quantities released to the atmosphere will eventually exceed those of today if sour gas production increases sufficiently.

## LEGISLATION and REGULATIONS

The presence of hydrogen sulphide in a large portion of Alberta's natural gas deposits has made it necessary for the government to pass legislation for the control of gas processing plant operations and this has been reflected in a number of regulations which the industry must follow in order to meet the standards set forth in the legislation. Two government agencies share the responsibility for ensuring that the industry complies with the legislation: the Department of the Environment by monitoring off site pollution levels, and the Energy Resources Conservation Board by concerning itself with on-site operations.

Of considerable importance are the ambient air quality standards that have been drawn up for Alberta. These standards, which prescribe the maximum permissible concentration of the more important established pollutants in the atmosphere, have been set by the government for the protection of the health and welfare of all citizens. Sulphur extraction gas plants must ensure that their emissions to the surrounding atmosphere do not result in pollutant levels which exceed the standards.

According to the Alberta Ambient Air Quality Standards, the acceptable levels for sulphur dioxide in the air are 0.2 part per million or 0.00002% averaged over a 30 minute period in an urban or agricultural area, or 0.3 part

per million over a 24 hour period in all areas. The average concentration allowed for hydrogen sulphide is 0.03 part per million for a one hour period and 0.005 part per million over a 24 hour period.

Although these allowable pollutant levels have been set as a protection for citizens and to prevent insofar as possible any deleterious effects to animals, plants and property, a lot remains to be determined about the long-term effects of very low concentrations of these gases in the atmosphere. As these effects become better understood it may be that the standards will have to be revised.

## ENVIRONMENTAL EFFECTS

Any plant processing sour natural gas may from time to time become the source of unpleasant odours. One of these odors which has often been likened to the smell of rotten eggs can be caused by trace amounts of hydrogen sulphide in the air. Although this odor, when it occurs, is usually predominant, odors due to sulphur dioxide and other chemicals may also be detected in some cases.

Because of the sensitivity of the human nose, odorous chemical substances can often be detected in extremely small quantities. The smallest concentration at which the human nose is able to detect the presence of a chemical substance is referred to as its threshold odor level. It varies not only from substance to substance, but also with different individuals and their physical state at the time. A good approximation of the threshold odor level is the concentration of the chemical at which one half of the number of persons of any group of normally healthy people will just detect the odor.

In the setting of ambient air quality standards, the absence of any detectable odor is usually one of the criteria on which the limits are based since even where no direct physical harm results, discomfort and even secondary physical effects may result from the presence of unpleasant odors. This can be particularly important in the case of the aged or those with respiratory or serious emotional problems.

In the case of hydrogen sulphide, odors may be detected in concentrations as low as 0.03 part per million whereas for sulphur dioxide, the detection level is 0.3 part per million and at this level appears to be a "taste" rather than a smell sensation. A noticeable pungent odor of sulphur dioxide

appears to require a concentration of 3 parts per million or one hundred times the level at which hydrogen sulphide can be detected by odor.

As far as is known, exposure for short periods of time to the minimum detection levels of these substances does not produce harmful effects.

Other environmental effects can be associated with blowouts at a wellhead or the rupture of a transmission line or plant equipment. In either case large quantities of hydrogen sulphide might escape and the resulting concentrations in the air can cause serious damage. Sulphur dust blowing into the air from sulphur storage piles has, in some cases, been cited as contributing to an increase in soil acidity and thereby endangering crop production. On the other hand, it is also said that if sulphur dust is added to an alkaline soil the resulting lowering of the alkalinity may actually enhance crop production. Contamination of ground water or streams by runoff from effluent ponds attached to gas plants, must also be considered a possible hazard.

Although the emphasis of the present study is focused on the obvious chemical compounds, such as hydrogen sulphide, sulphur dioxide and elemental sulphur, there are other substances which may be the cause of environmental damage, and attention should be directed to these as well. Examples of these are traces of Mercaptans and other compounds or elements which may be present in the sour gas, Carbonyl Sulphide and Carbon Disulphide which may be formed during the sulphur extraction operation, and various spent chemicals from general plant operations. Of particular importance is the establishment of the presence of these materials in the waste gases leaving the gas plants and the effects that can be attributed to them in the concentrations in which they then occur in the air surrounding the plant.

## THE PUBLIC HEARINGS

During the hearings on the environmental effects of sulphur extraction gas plants an opportunity will be afforded for all concerned to express their views on this important subject. Briefs will be invited from individual citizens, cities, towns, labour and farm organizations, members of the academic community, women's groups, environmental groups, industry representatives, school groups and any other groups which might wish to present information on the subject.

At the request of the Environment Conservation Authority the Research Council of Alberta provided the services of a consultant to prepare a situation report on the environmental effects of sulphur extraction gas plants. This report is a public document, available at the offices of the Authority. It is intended to present an overview of the subject and provide a basis for discussion, and the Authority does not necessarily agree or disagree with anything contained in it. Topics discussed in this report include: the magnitude of the sulphur industry; extraction plant operation; plant effluents; meteorological dispersal of gaseous pollutants particularly sulphur dioxide, the effects on humans, animals and vegetation of various pollutants and what is known about them, and pollution control legislation affecting the sulphur extraction plants.

Participants at the hearings are encouraged to present briefs on any environmental aspect connected with the production, transportation and processing of sour gas and the storage, handling and transportation of the products to their markets.

It is expected that attention will be directed to such specifics as:

1. long and short range effects on the health of humans and animals;
2. effects on vegetation;
3. effects on inanimate property;
4. case histories of alleged effects of sulphurous gases on human plant or animal health or the safety of property.
5. environmental protection methods employed by the industry;
6. environmental effects inside the plant;
7. legislation, regulations, and standards;
8. monitoring systems and methods of measurement;
9. odors and their effects on humans and animals;
10. the need for research;
11. the role of government and industry in environmental protection.

The Authority hopes that some briefs will be able to provide first hand or specialized information on particular aspects of the subject about which general knowledge is deficient, or where misconceptions might be considered to exist. Factual information or data on cause/effect relationships connected with the operation of gas plants and their transmission lines, would be of particular interest.

All interested groups and individuals, and the general public are encouraged to attend the hearings and make their views known. On completion of the hearings reports will be made to the public in three ways. Firstly, all briefs presented to the hearings as well as all ensuing discussions will be recorded, assembled as the "Proceedings" of the Hearings, and published in book form by the Authority at nominal cost. Secondly, a "Summary" of the Hearings will be produced, also in book form, for free distribution on request.

Finally the Authority will develop its "Report and Recommendations" for submission to the Minister of the Environment and the Legislative Council. This report will also become freely available to the public as soon as it is tabled by the Minister in the House.